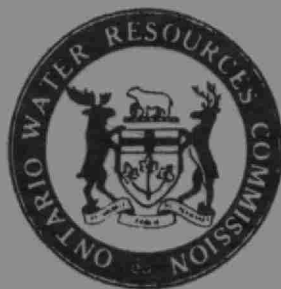


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THE
ONTARIO WATER RESOURCES
COMMISSION

MOIRA LAKE

ALGAE PROBLEMS

1964

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ALGAE PROBLEMS - 1964
MOIRA LAKE

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1964

Moir Lake algae problems.

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MOIRA LAKE
ALGAE PROBLEMS
1964

Reports Sent To:

J.F. King, Field Officer,
Moir River Conservation Authority,
Box 13, Municipal Building,
Cannifton, Ontario.

T. Burnside, Reeve,
Village of Madoc,
Madoc, Ontario.

J.A. Pitts,
R.R. # 2,
Madoc, Ontario.

Investigations by: C.F. Schenk,
Biologist
R.N. Dawson, P. Eng.

REPORT

Ontario Water Resources Commission

Municipality _____ County of Hastings _____ Date of Inspection June 17th, 1964
September 23rd, 1964
Re: Moira Lake - Algae Problems
Field Inspection by R.N. Dawson, P. Eng. C.F. Schenk, Biologist
G.F. Schenk, Biologist Report by R.N. Dawson, P. Eng.

INTRODUCTION

During 1964 two complaints of excessive algae growths and associated malodorous conditions were reported and investigated on Moira Lake on June 17th and September 23rd. Previously algae problems have been reported each year during the summer season. Examinations of the collected algae samples were carried out at the OWRC laboratory.

DESCRIPTION OF MOIRA LAKE

Moira Lake is situated on the Upper Moira River approximately 40 miles upstream from the river's mouth at Lake Ontario. The lake occupies approximately 3.1 square miles of surface area and is divided into two distinct basins by the county road leading north to the Village of Madoc. The western or upstream basin is approximately 0.8 square miles in area and has an average depth of approximately 12.0 feet. The western portion is much larger having a surface area of 2.3 square miles and an approximate average depth of 24 feet. Development around the lake consists of the Village of Madoc with its population of 1,693 persons and a large number of summer cottages surrounding the lake shore.

A Department of Lands and Forests' report has indicated that the lake is naturally eutrophic i.e. organically enriched and it is a very productive game fishery. Abundant growths of submergent and emergent aquatic plants are present in the shallow bay areas particularly in the western basin. The lake water is highly coloured.

Sources of organic enrichment include, runoff from upstream agricultural lands, discharges from the Town of Madoc primary sewage treatment plant and seepage and runoff from the developing summer cottage properties. The Madoc sewage treatment plant flows to Deer Creek (Madoc Creek) which is a tributary to the western basin. The nearest source of upstream pollution is the effluent from the Village of Deloro septic tank underdrainage system approximately 13 miles upstream.

JUNE 17th INVESTIGATION

At the request of Mr. T. Burnside, Reeve, Village of Madoc, Mr. J.F. King, Field Officer, Moira River Conservation Authority relayed a complaint of algae problems to the OWRC. An examination of the whole lake was made by boat by R.N. Dawson on June 17th.

According to Mrs. T. Burnside who was interviewed at the time, algae blooms commenced after ice break-up as soon as the warm weather arrived. Algae was washed up on the beach and into the shallow water where it decomposed and caused unbearable odours.

At the time of the investigation the problem had decreased in intensity. However, decaying algae mats were discovered on the beaches along the north shore and caught in pockets near the county road causeway as shown on the attached map. Samples were collected of the free floating mats, accumulations near the north shore, attached forms and plankton forms in the deeper water. Evidence of decayed algae was found at points above the existing water line along both sides of the lake. The report of the algae identifications and counts is attached.

The count near the outlet of Moira Lake is fairly high at 952 areal standard units with a predominance of flagellates. Throughout the entire lake, the filamentous green algae species were the most plentiful. The floating mats were mainly composed of the filamentous green algae Spirogyra and Cladophora. Plankton forms observed in the deeper water consisted mostly of flagellates.

SEPTEMBER 23rd INVESTIGATION

In response to a complaint of algal blooms reported by Mr. J.A. Pitts of Pitts Landing, a tourist camp owner, Mr. C.F. Schenk, Biologist, investigated on September 23rd. Faint-like accumulations having a vivid blue green colour were present in two foot wide bands in all of the bays along the north shore in the vicinity of Pitts Landing. Opaque water conditions extended 50 to 75 feet from shore due to the presence of plankton forms. Numerous dead fish and snails were observed throughout the area.

Apparently the algae had developed during a particularly calm, warm weather period and had been blown against the north shore by south-west winds on September 22nd.

Four samples were obtained from the lake in that portion fronting on Pitts Landing at 30 feet from the south shore, centre of the lake, 100 feet from the north shore and 20 feet from the north shore. Algae counts on three of the four samples counted were much higher than the counts obtained in June. A progressive increase was observed from the south to north shore with the last sample having such a dense concentration that counting was not practical. The blue green algae Oscillatoria and Aphanizominon were the most abundant showing a similar trend to the general counts. Observations made in the western basin of the lake indicated that accumulations of blue green algae were not as substantial as in that part of the lake east of the causeway. The prevailing south-west wind had undoubtedly blown the blue green algae along the surface resulting in copious accumulations on the north shore of the western section.

DISCUSSION

The algae observed on the two OWRC investigations are normal inhabitants of surface waters classed as productive areas. On both occasions complaints had been received following the production of floating mats and blooms of algae. In the early summer the mats were composed of the filamentous green algae

Spirogyra and Cladophora while the blooms observed in September were mainly composed of the blue green algae Oscillatoria, Aphanizominon and Anacystis. This is typical of a normal seasonal cycle of algae growth. Blue green algae blooms are usually associated with periods of calm, warm weather in which the algae normally distributed throughout the entire water mass rise to the surface. Such a situation occurred in September.

With regard to the dead fish and snails noted during the last investigation; it should be noted that where there is a heavy growth of algae, a reduction in the amount of sunlight will reduce the photosynthetic effect of algae. With insufficient oxygen available the algae are forced to respiration and therefore reduce the oxygen available in the lake. As a result, fish and other life die from oxygen starvation. In addition, the concentrations of Aphanizominon itself may have resulted in toxic effects.

Many of the local residents and cottage owners have expressed concern over the recurring algae problems which are claimed to be interfering with the tourist business and reducing cottage property values. Although the sewage discharges upstream and the surrounding cottage development are doubtlessly adding nutrients to the lake, Moira Lake is naturally a productive body of water and concentrated growths of algae must be expected when conditions are favourable for growth.

ALGAE CONTROL

Control of many of the forms by the use of copper sulphate as an algicide would not seem to be economically feasible. A preventative application applied early in the spring would have to be followed by a second application during the summer. At concentrations of 0.75 ppm CuSO_4 and considering a chemical cost of 20 cents per pound the 11.28×10^9 gallons of water could be treated for algal control at a total chemical cost of approximately \$17,000.00. The use of special equipment and qualified personnel would result in a much higher cost. In addition many of the forms discovered are resistant to copper sulphate treatment, eg: Cladophora. Since Moira Lake is an important game fishery toxicity to some forms of fish may be caused. The use of other algicides which would control Cladophora would definitely be toxic to game fish.

The only alternative to algicide control would be the actual mechanical removal of the algae accumulation in the shallows as soon as they develop. Burial of collected algae would then be recommended.

SUMMARY

Investigations of the algae problems in Moira Lake indicate that the algae blooms are normal occurrences caused by the development of ideal growth conditions on a naturally productive lake.

Control of the growth by timely application of algicides would be prohibitively expensive and may cause danger of a toxic environment in a valuable game fishery. Under expert supervision by members of the OWRC algicide control might be attempted to give a measure of relief in coming years. Mechanical collection and disposal of the algae accumulations could be attempted.

RECOMMENDATIONS

It is recommended that as algae accumulations develop on the beaches, mechanical removal and burial be implemented.

All of which is respectfully submitted,

Supervisor: W. A. Steggle

W. A. Steggle

Approved by: E. H. Sharpe

E. H. Sharpe, Director

ONTARIO WATER RESOURCES COMMISSION
BIOLOGICAL LABORATORY
PLANKTON ANALYSES

Total Algae/ml. in Areal Standard Units
*1 a.s.u. = 400 square microns

Municipality: Moira Lake		Report to: Bob Dawson			cc. K. Sharpe
Source: Moira Lake		Sampled by: Bob Dawson			File
		Analysed by: C. F. Schenk			
Date Sampled:	6-19-64	6-19-64	6-19-64	6-19-64	
Location:	Attached Forms	County Rd. Bridge	County Rd. Bridge	Hwy. 7 below Deloro	Burnside cottage, N. side
Lab. No:	B-228	B-229 (floating mat)	B-231 (free floating)		
Blue-Green Algae		Lyngbya predominant (filamentous)	Anabaena present and quite abundant.		Oscillatoria - present
Green Algae	Cladophora, Spirogyra and Ulothrix present - Cladophora predominant	Cladophora, Spirogyra, Oedogonium and Tribonema present (all filamentous)	Pediastrum - present	Chlamydomonas - observed Chlorella - observed	Spirogyra - extremely abundant - filaments visible in sample to naked eye. Staurostrum - present Schroederia - present
Flagellates			Ceratium - present		
Diatoms			Stephanodiscus Melosira Navicula	Navicula - observed Synedra - observed	Navicula - present Synedra - present Gomphonema - present
Total Algae/ml.*			Algae abundant in this sample	Numbers of algae extremely low - almost insignificant.	Algae other than Spirogyra not too abundant.
Other					
	No. per ml.				

Remarks:

Municipality: Moira Lake		Report to: Bob Dawson		cc. K. Sharpe	
Source: Moira Lake		Sampled by: Bob Dawson		File	
		Analysed by: David Osmond			
Date					
Sampled:	6-19-64		6-19-64		
Location:	Raw Water - County Road Bridge		Raw Water - Outlet		
Lab. No:	B-230		B-232		
Blue-Green Algae			Oscillatoria 13.55		
			Total 13.55		
Green Algae	Chlorella 30.39	Dictyosphaerium 13.35	Chlorella 83.83		
	Closterium 5.12		Ankistrodesmus 37.25		
	Ankistrodesmus 6.55		Micratinium 11.53		
	Pediastrum 7.66		Schroederia 44.74		
	Sphaerocystis 24.44	Total 134.57	Staurostrum 27.73		
	Micratinium 4.07		Total 205.08		
	Stephanodiscus 39.56				
	Scenedesmus 3.43				
Flagellates	Ceratium 149.50		Dinobryon 390.36		
	Chlamydomonas 11.41		Chlamydomonas 128.83		
	Dinobryon 5.13		Euglena 42.71		
	Total 166.04		Total 561.90		
Diatoms	Melosira 83.13		Synedra 24.43		
	Asterionella 34.69		Fragilaria 4.63		
	Total 117.82		Navicula 37.07		
			Melosira 23.17		
			Tabellaria 82.37		
			Total 171.67		
Total Algae/ml.*		418.43	952.20		
Other			Daphnia 1		
No. per ml.			9.35		

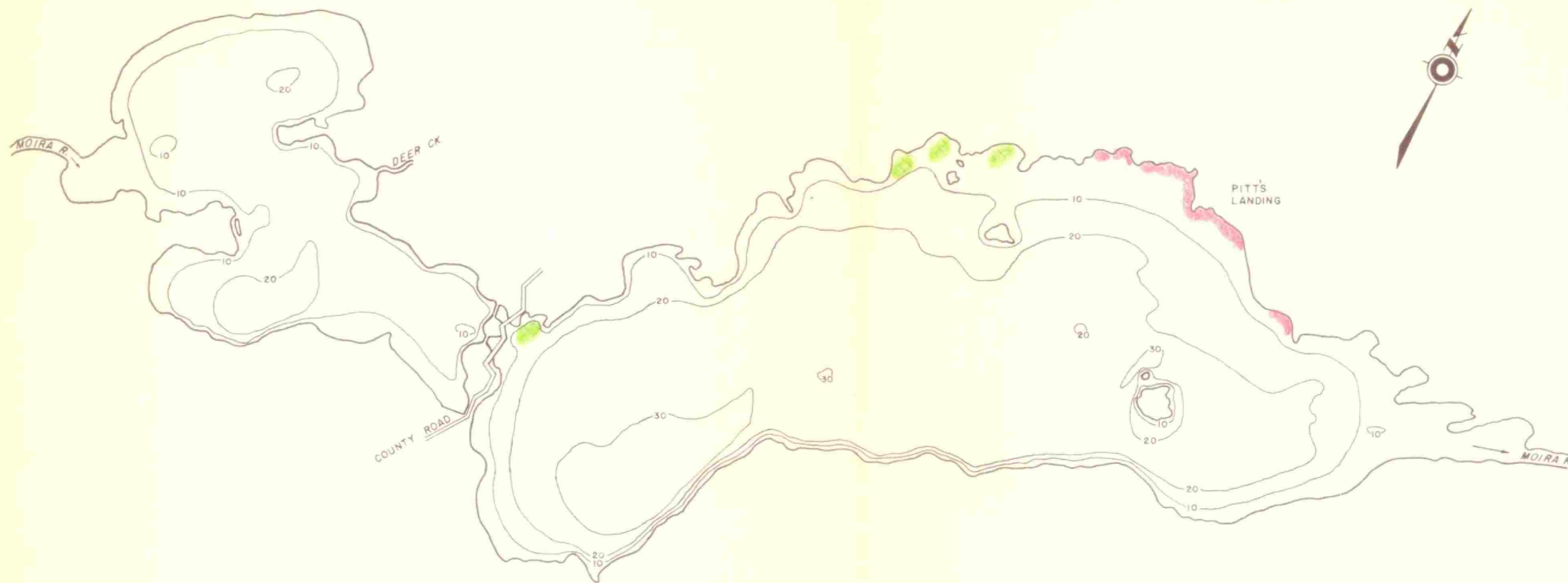
Remarks:

ONTARIO WATER RESOURCES COMMISSION
BIOLOGICAL LABORATORY
PLANKTON ANALYSES

Total Algae/ml. in Areal Standard Units
*1 a.s.u. = 400 square microns

Municipality:		Report to: C.F. Schenk		cc.	
Source: Moira Lake		Sampled by: C.F. Schenk		R. Dawson	
		Analysed by: C.F. Schenk			
Date					
Sampled:	Sept. 23, 1964	Sept. 23, 1964	Sept. 23, 1964	Sept. 23, 1964	
Location:	30' off south shore	centre of lake	100' off north shore	20' off north shore	
Lab. No:	B816	B817	B818	B819	
Blue-Green Algae	Oscillatoria	Oscillatoria	Oscillatoria	Algae were not counted in this sample. Oscillatoria and Aphanizomenon were so numerous that they imparted a paint-like blue-green colour to the shoreline. Aphanizomenon was predominant on the sample. Algae were so dense out to 50' that the water was quite opaque because of their presence.	
	95.0	140.8	1500.6		
	Aphanizomenon	Aphanizomenon	Aphanizomenon		
	48.2	1203.4	5039.0		
	Anacystis	Gomphosphaeria	Anacystis		
Green Algae	126.5	35.8	250.3		
	Total	Anacystis	Total		
	269.7	28.5	6789.9		
		Total			
		1408.5			
Flagellates	Pediastrum	Scenedesmus	Scenedesmus		
	386.4	39.5	57.9		
	Scenedesmus	Selenastrum	Selenastrum		
	11.2	4.8	36.6		
	Schroederia	Staurostrum	Staurostrum		
	5.8	110.6	18.1		
	Selenastrum	Oocystis	Oocystis		
	2.8	25.2	12.4		
	Chlorella	Ankistrodesmus	Chlorella		
	14.9	25.2	13.8		
Diatoms	Oocystis	Chlorella	Total		
	15.4	17.3	138.8		
	Micratinium	Total			
	21.2	222.6			
	Staurostrum				
Flagellates	49.0				
	Total				
	506.7				
Diatoms	Peridinium	Ceratium	Unknown flagellate		
	13.8	117.6	69.7		
	Trachelomonas	Chlamydomonas	Chlamydomonas		
	21.2	6.4	4.0		
	Chlamydomonas	Total	Total		
Diatoms	5.3	124.0	73.7		
	Total				
	40.3				
Diatoms	Melosira	Melosira	Melosira		
	1046.5	1742.0	1012.7		
	Synedra	Cyclotella	Nayicula		
	16.1	34.2	23.9		
	Cyclotella	Stephanodiscus	Cocconcis		
Diatoms	24.6	38.5	94.1		
	Stephanodiscus	Total	Total		
	126.7	1814.7	1130.7		
	Total				
	1213.9				
Total Algae/ml.*	2030 a.s.u.	3570 a.s.u.	8133 a.s.u.		
Other					
No. per ml.					

Remarks:



LEGEND
— 10 — DEPTH CONTOURS IN FT
→ DIRECTION OF FLOW
ALGAE ACCUMULATIONS
JUNE 17 
SEPT. 23 

MOIRA LAKE

1000 500 0 1000 2000 3000 FT